

WHAT IS CLAIMED IS:

1. A braking control device comprising:
 - a forward object detecting section configured to detect an object in front of a vehicle in which the braking control device is installed;
 - 5 an avoidance possibility determining section configured to determine if the object detected in the front of the vehicle by the forward object detecting section can be avoided by at least one of steering and braking;
 - an automatic braking section configured to execute automatic braking when the avoidance possibility determining section determines that the object cannot be avoided by
 - 10 at least one of steering and braking; and
 - a vehicle behavior response characteristic determining section configured to determine a vehicle behavior response characteristic that includes at least one of a suspension characteristic of the vehicle based on a suspension characteristic setting, a steering avoidance direction force that will be generated in the steering avoidance
 - 15 direction should the object detected in the front of the vehicle by the forward object detecting section be avoided by steering, a change in a vehicle condition that results in deceleration of the vehicle, and a vehicle-object relationship between a traveling speed of the vehicle and a distance the object and the vehicle that is corrected using a non-linear traveling speed based correction coefficient,
 - 20 the avoidance possibility determining section being further configured to set a method by which the object that is determined to be in the front of the vehicle can be avoided by at least one of steering and braking based on the vehicle behavior response characteristic determined by the vehicle behavior response characteristic determining section.

25

2. The braking control device recited in claim 1, wherein the avoidance possibility determining section includes a steering avoidance determining section configured to determine if the object detected in the front of the vehicle by the forward object detecting section can be avoided by steering.

30

3. The braking control device recited in claim 2, further comprising
a suspension characteristic setting section being configured to change the
suspension characteristic setting of the vehicle, and
the steering avoidance determining section further being configured to set the
5 method by which the object that is determined to be in the front of the vehicle can be
avoided by steering based on the suspension characteristic setting set by the suspension
characteristic setting section.

4. The braking control device recited in claim 2, further comprising
10 a steering avoidance direction force calculating section being configured to
calculate the steering avoidance direction force that will be generated in the steering
avoidance direction should the object detected in the front of the vehicle by the forward
object detecting section be avoided by steering, and
the steering avoidance determining section being further configured to set the
15 method by which the object that is determined to be in the front of the vehicle can be
avoided by steering based on the steering avoidance direction force calculated by the
steering avoidance direction force calculating section.

5. The braking control device recited in claim 4, wherein
20 the steering avoidance direction force calculating section calculates a longitudinal
force and a load acting on wheels of the vehicle and calculates the steering avoidance
direction force based on the longitudinal force and the load.

6. The braking control device recited in claim 1, wherein
25 the avoidance possibility determining section includes a braking avoidance
determining section configured to determine if the object detected in the front of the
vehicle by the forward object detecting section can be avoided by braking.

7. The braking control device recited in claim 6, further comprising
30 a throttle-fully-closed deceleration calculating section being configured to
calculate an accelerator pedal release deceleration that will result should an accelerator
pedal be released, and

the braking avoidance determining section being configured to set the method by which the object that is determined to be in the front of the vehicle can be avoided by braking based on the accelerator pedal release deceleration calculated by the throttle-fully-closed deceleration calculating section.

5

8. The braking control device recited in claim 2, wherein
the avoidance possibility determining section includes
 - a steering avoidance threshold value setting section configured to set a variable steering avoidance threshold value for determining if the object detected in front of the vehicle by the forward object detecting section can be avoided by steering based on the vehicle-object relationship between the traveling speed of the vehicle and the distance the object and the vehicle that is corrected using the non-linear traveling speed based correction coefficient,
 - 10 a steering avoidance possibility determining section configured to determine that the object detected in the front of the vehicle by the forward object detecting section cannot be avoided by steering when the vehicle-object relationship between the object and the vehicle matches the variable steering avoidance threshold value set by the steering avoidance threshold setting value setting section,
 - 15 and
 - a traveling speed detecting section that detects the traveling speed of the vehicle,
- 20 the steering avoidance threshold value setting section being configured to set the steering avoidance threshold value for determining if the object in the front of the vehicle can be avoided by steering based on the vehicle traveling speed detected by the traveling speed detecting section.

9. The braking control device recited in claim 8, wherein
the steering avoidance threshold value setting section adjusts the variable threshold
value for determining if the object can be avoided by steering based on at least one of a
time and the distance between the vehicle and the object, and

5 the steering avoidance threshold value setting section further adjusts the variable
threshold value for determining if the object can be avoided based on the traveling speed
of the vehicle as detected by the traveling speed detecting section such that a first
threshold value is set when the traveling speed is within a low speed region, a second
threshold value is set when the traveling speed is within a medium speed region, and a
10 third threshold value is set when the traveling speed is within a high speed region, with the
first threshold value for the low speed region being set larger than the second and third
threshold values of the medium speed region and the high speed region, respectively, and
the second threshold value for the medium speed region being set smaller than the first and
third threshold values of the low speed region and high speed region, respectively.

15

10. The braking control device recited in claim 8, wherein
the steering avoidance determining section is further configured to adjust the
variable steering avoidance threshold value based on a suspension characteristic setting set
by a suspension characteristic setting section.

20

11. The braking control device recited in claim 8, wherein
the steering avoidance determining section is further configured to adjust the
variable steering avoidance threshold value based on a steering avoidance direction force
calculated by a steering avoidance direction force calculating section.

25

12. The braking control device recited in claim 11, wherein
the steering avoidance determining section is further configured to adjust the
variable steering avoidance threshold value based on a suspension characteristic setting set
by a suspension characteristic setting section.

30

13. The braking control device recited in claim 12, wherein
the steering avoidance threshold value setting section adjusts the variable threshold
value for determining if the object can be avoided by steering based on at least one of a
time and the distance between the vehicle and the object, and

5 the steering avoidance threshold value setting section adjusts the variable threshold
value for determining if the object can be avoided based on the traveling speed of the
vehicle as detected by the traveling speed detecting section such that a first threshold value
is set when the traveling speed is within a low speed region, a second threshold value is set
when the traveling speed is within a medium speed region, and a third threshold value is
10 set when the traveling speed is within a high speed region, with the first threshold value
for the low speed region being set larger than the second and third threshold values of the
medium speed region and the high speed region, respectively, and the second threshold
value for the medium speed region being set smaller than the first and third threshold
values of the low speed region and high speed region, respectively.

15

14. The braking control device recited in claim 8, wherein
the avoidance possibility determining section includes a braking avoidance
determining section configured to determine if the object detected in the front of the
vehicle by the forward object detecting section can be avoided by braking.

20

15. The braking control device recited in claim 14, further comprising
a throttle-fully-closed deceleration calculating section being configured to
calculate an accelerator pedal release deceleration that will result should an accelerator
pedal be released, and

25

 the braking avoidance determining section being configured to set the method by
which the object that is determined to be in the front of the vehicle can be avoided by
braking based on the accelerator pedal release deceleration calculated by the throttle-fully-
closed deceleration calculating section.

16. The braking control device recited in claim 2, further comprising the avoidance possibility determining section includes a braking avoidance determining section configured to determine if the object detected in the front of the vehicle by the forward object detecting section can be avoided by braking.

5

17. A braking control device comprising:
forward object detecting means for detecting an object in front of a vehicle in which the braking control device is installed;
avoidance possibility determining means for determining if the object detected in
10 the front of the vehicle by the forward object detecting section can be avoided by at least one of steering and braking;
automatic braking means for executing automatic braking when the avoidance possibility determining means determines that the object cannot be avoided by at least one of steering and braking; and
15 vehicle behavior response characteristic determining means for determining a vehicle behavior response characteristic that includes at least one of a suspension characteristic of the vehicle based on a suspension characteristic setting, a steering avoidance direction force that will be generated in the steering avoidance direction should the object detected in the front of the vehicle by the forward object detecting section be
20 avoided by steering, a change in a vehicle condition that results in deceleration of the vehicle, and a vehicle-object relationship between a traveling speed of the vehicle and a distance the object and the vehicle that is corrected using a non-linear traveling speed based correction coefficient,
the avoidance possibility determining means being further configured to set a
25 method by which the object that is determined to be in the front of the vehicle can be avoided by at least one of steering and braking based on the vehicle behavior response characteristic determined by the vehicle behavior response characteristic determining section.

30

18. A method of controlling vehicle braking comprising:
detecting an object in front of a vehicle;
determining if the object detected in the front of the vehicle can be avoided by at
least one of steering and braking, where an avoidance possibility determination is made
5 based on

determining a vehicle behavior response characteristic that includes at
least one of a suspension characteristic of the vehicle based on a
suspension characteristic setting, a steering avoidance direction
force that will be generated in the steering avoidance direction
10 should the object detected in the front of the vehicle by the
forward object detecting section be avoided by steering, a change
in a vehicle condition that results in deceleration of the vehicle,
and a vehicle-object relationship between a traveling speed of the
vehicle and a distance the object and the vehicle that is corrected
15 using a non-linear traveling speed based correction coefficient,
and;

executing automatic braking upon determining that the object cannot be avoided by
at least one of steering and braking.

20 19. The method recited in claim 18, wherein
the avoidance possibility determination is performed by
detecting the vehicle traveling speed,
setting a variable steering avoidance threshold value for determining if
the object detected in front of the vehicle by the forward object
25 detected in front of the vehicle can be avoided by steering based
on the vehicle-object relationship between the traveling speed of
the vehicle and the distance the object and the vehicle that is
corrected using the non-linear traveling speed based correction
coefficient, and
30 determining that the object detected in the front of the vehicle by the
forward object detecting section cannot be avoided by steering
when the vehicle-object relationship between the object and the

vehicle matches the variable steering avoidance threshold value based on the vehicle traveling speed detected.

20. The method recited in claim 19, wherein
5 the avoidance possibility determination is further performed by
adjusting the variable threshold value for determining if the object can
be avoided by steering based on at least one of a time and the
distance between the vehicle and the object, and
further adjusting the variable threshold value for determining if the
10 object can be avoided based on the traveling speed of the vehicle
such that a first threshold value is set when the traveling speed is
within a low speed region, a second threshold value is set when the
traveling speed is within a medium speed region, and a third
threshold value is set when the traveling speed is within a high
15 speed region, with the first threshold value for the low speed
region being set larger than the second and third threshold values
of the medium speed region and the high speed region,
respectively, and the second threshold value for the medium speed
region being set smaller than the first and third threshold values of
20 the low speed region and high speed region, respectively.

21. The method recited in claim 19, wherein
further adjusting of the variable steering avoidance threshold value is based on a
suspension characteristic setting.

25
22. The method recited in claim 19, wherein
further adjusting of the variable steering avoidance threshold value is based on a
steering avoidance direction force.

30
23. The method recited in claim 22, wherein
further adjusting of the variable steering avoidance threshold value is based on a
suspension characteristic setting.

24. The method recited in claim 19, wherein
the avoidance possibility determination is further performed by determining if the
object detected in the front of the vehicle by the forward object detecting section can be
5 avoided by braking.